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Development of high fodder-yielding sweet sorghum strain Madhura-2 (NARI-SS-5) for production under monsoon and post-monsoon seasons

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Introduction

Sweet sorghum owing to its high fodder yielding ability coupled with sweet and juicy stalks is more often used as a fodder crop in India than for its intended use as a sugar or bio-energy crop (Nimbkar *et al.*, 2010). In addition, fodder quality of sweet sorghum is as good as that of the fodder sorghums. Sweet sorghum is also produced as forage in China (Zhu, 1998) and USA (Suttie, 2000). Sorghum genotypes rich in sugar are reported to have a better quality of fodder than the regular genotypes with low sugar content (Singh and Katiyar, 2003). With its concerted efforts for over four decades in improvement of sweet sorghum, Nimbkar Agricultural Research Institute, at Phaltan has developed a high fodder-yielding sweet sorghum strain Madhura-2 (NARI-SS-5) by crossing an American sweet sorghum cultivar Keller with an indigenous genotype NSS-218 following the pedigree method of breeding. Madhura-2 is highly suitable for production under monsoon and post-monsoon seasons and present paper discusses its performance in the two seasons.

Materials and Methods

Madhura-2 was evaluated in multi location varietal trials under the All India Coordinated Sorghum Improvement Project (AICSIP) at nine locations across India during monsoon and at three locations during post-monsoon seasons for three-years (2012-2014). At each location the trial was sown in a randomized block design with three replications. Each treatment was sown in an area of 3.6 X 5 m. The spacings between rows and plants were 60 and 15 cm respectively. Uniformly standard agronomic practices were followed to conduct the trial. The observations of days to 50% flowering, green fodder yield (total fresh biomass yield) and juice yield were recorded on the whole plot basis, while 10 randomly selected plants were used to record observations on juice extraction (%), juice brix (%) and plant height (cm). Pooled analysis was carried out as per the standard method in use.

Results and Discussion

Performance of Madhura-2 (NARI-SS-5) in monsoon conditions: Madhura-2 recorded the highest average (weighted mean) green fodder yield of 52 t/ha as compared to 42 t/ha for the national check CSV-19-SS, 44 t/ha for the other national check CSV-24-SS and 48 t/ha for the hybrid check CSH-22-SS (Table 1). Thus Madhura-2 outyielded the three checks CSV-19-SS, CSV-24-SS and CSH-22-SS by 24, 20 and 9% respectively (Table 2). Moreover, Madhura-2 recorded an average plant height of 300 cm as compared to 293, 289 and 302 cm for national checks CSV-19-SS, CSV-24-SS and CSH-22-SS respectively. Juice extraction % of Madhura-2 was 37.3 and similar to that of the three checks. Similarly brix % of juice of Madhura-2 was 16.64 which were also at par with that of the three checks. Madhura-2 recorded significantly higher juice yield of 15073 l/ha than the 11447 l/ha of the national check CSV-19-SS and 10978 l/ha of the other check CSV-24-SS. It was numerically higher than the 12722 l/ha of the hybrid checks CSH-22-SS. Thus it gave 32, 37 and 18% higher juice yield than the checks CSV-19-SS, CSV-24-SS and CSH-22-SS respectively. Days to 50% flowering for Madhura-2 were 88 as compared to 78 for national check CSV-19-SS, 85 for the other check CSV-24-SS and 82 for the hybrid check CSH-22-SS.

Table 1: Green fodder yield and other characteristics of Madhura-2 (NARI-SS-5) in AICSIP trials (Pooled over locations and years from 2012-2014)

Entry	Monsoon						Post-monsoon					
	Green fodder yield (t/ha)	Plant height (cm)	Juice extraction (%)	Juice brix (%)	Juice yield (l/ha)	Days to 50% flowering	Green fodder yield (t/ha)	Plant height (cm)	Juice extraction %	Juice brix (%)	Juice yield (l/ha)	Days to 50% flowering
Madhura-2 (NARI-SS-5)	52.17	299.62	37.29	16.64	15073	87.83	39.71	232.36	40.7	13.85	11453	72.45
CSV-19-SS (National Check)	41.94	292.68	36.70	16.61	11447	77.90	33.98	227.27	40.6	13.02	7613	63.91
CSV-24-SS (National Check)	43.60	288.91	35.47	16.35	10978	85.36	30.53	217.18	36.7	10.48	6703	68.64
CSH-22-SS (Hybrid Check)	47.62	301.59	37.30	16.68	12722	82.47	34.95	236.18	40.5	10.72	7627	69.55
CD 0.05	8.56	17.06	4.37	1.10	2539.4	3.63	6.86	19.6	7.57	2.27	4421	3.23
CV (%)	20.14	8.01	13.98	8.33	18.47	5.37	13.03	5.11	11.01	12.06	16.97	3.26

Table 2: Year-wise green fodder and juice yields of Madhura-2 in AICSIP trials from 2012-2014 (Pooled over locations)

Entry	Monsoon					
	Green fodder yield (t/ha)			Juice yield (l/ha)		
	2012	2013	2014	2012	2013	2014
Madhura-2 (NARI-SS-5)	61.41	42.64	52.46	18394.60	11240.00	16670.50
CSV-19-SS (National Check)	52.09	35.10	38.62	12426.00	9745.00	12775.00
CSV-24-SS (National Check)	55.26	33.49	42.07	12186.40	9231.67	12087.50
CSV-22-SS (National Check)	58.84	39.16	44.86	14951.20	10388.33	13434.75
CD 0.05	7.80	7.00	10.88	3061.00	173.00	4384.20
CV (%)	15.78	19.43	25.20	15.00	19.08	21.32

Entry	Post- monsoon					
	Green fodder yield (t/ha)			Juice yield (l/ha)		
	2012	2013	2014	2012	2013	2014
Madhura-2 (NARI-SS-5)	35.33	47.38	35.33	11562.00	13277.50	9465.00
CSV-19-SS (National Check)	30.18	38.53	33.00	8115.67	9094.00	5377.50
CSV-24-SS (National Check)	32.15	32.80	25.33	8832.33	5674.00	4538.00
CSV-22-SS (National Check)	32.35	41.50	29.67	8459.33	8808.50	5197.00
CD 0.05	8.10	7.80	4.70	4851.00	2712.00	5700.00
CV (%)	17.21	13.87	8.00	22.80	21.34	6.76

Performance of Madhura-2 (NARI-SS-5) in post-monsoon conditions: Madhura-2 gave the significantly highest green fodder yield of 40 t/ha as against 34, 30 and 35 t/ha for the national checks CSV-19-SS, CSV-24-SS and CSH-22-SS (Table 1) respectively thereby giving an overall increase of 17%, 30% and 14% over CSV-19-SS, CSV-24-SS and CSH-22-SS respectively. Plant height of Madhura-2 was 232 cm while it was 227 cm for CSV-19-SS, 217 cm for CSV-24-SS and 236 cm for CSH-22-SS. The juice extraction of Madhura-2 under post-monsoon conditions was 41% whereas it was 41%, 37% and 40% for CSV-19-SS, CSV-24-SS and CSH-22-SS respectively. The juice brix % in Madhura-2 was 13.85 as against 13.02, 10.48 and 10.72 in CSV-19-SS, CSV-24-SS and CSH-22-SS respectively. Madhura-2 recorded significantly highest juice yield of 11453 l/ha as compared to 7613 l/ha for national check CSV-19-SS, 6703 l/ha for the other check CSV-24-SS and 7627 l/ha for the hybrid check CSH-22-SS thereby giving an increase of 50, 71 and 50% respectively over them. Similar to monsoon season in post-monsoon season also for Madhura-2, days to 50% flowering were somewhat more at 72 days as compared to 64 days for CSV-19-SS and 69 days for both CSV-24-SS and CSH-22-SS (Table 1).

Thus in post-monsoon season Madhura-2 proved its considerable superiority over all the three checks for green fodder yield, juice brix and juice yield. In the absence of any sweet sorghum variety for production under post-monsoon

conditions in India, Madhura-2 meets all the requirements of high fodder yield, juice yield, juice extraction % and juice brix % needed for recommendation of the variety. Its superiority in green fodder and juice yields over the checks in each individual year can be seen from Table 2.

Conclusion

The evaluation of sweet sorghum variety Madhura-2 in multilocation coordinated trials under monsoon and post-monsoon seasons revealed its very high performance for green fodder yield in monsoon and post-monsoon seasons with a considerable increase over the national sweet sorghum checks CSV-19-SS, CSV-24-SS and hybrid check CSH-22-SS. Similarly Madhura-2 out yielded all the three national checks by high margins for juice yield under monsoon and post-monsoon seasons. The high juice brix % of Madhura-2 will help in increasing the palatability of its fodder and reducing the wastage of feed. Thus Madhura-2 is highly suitable for fodder production under both monsoon and post-monsoon seasons throughout India.

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